Market Design Evolution and Forecast Integration in Ireland and Northern Ireland

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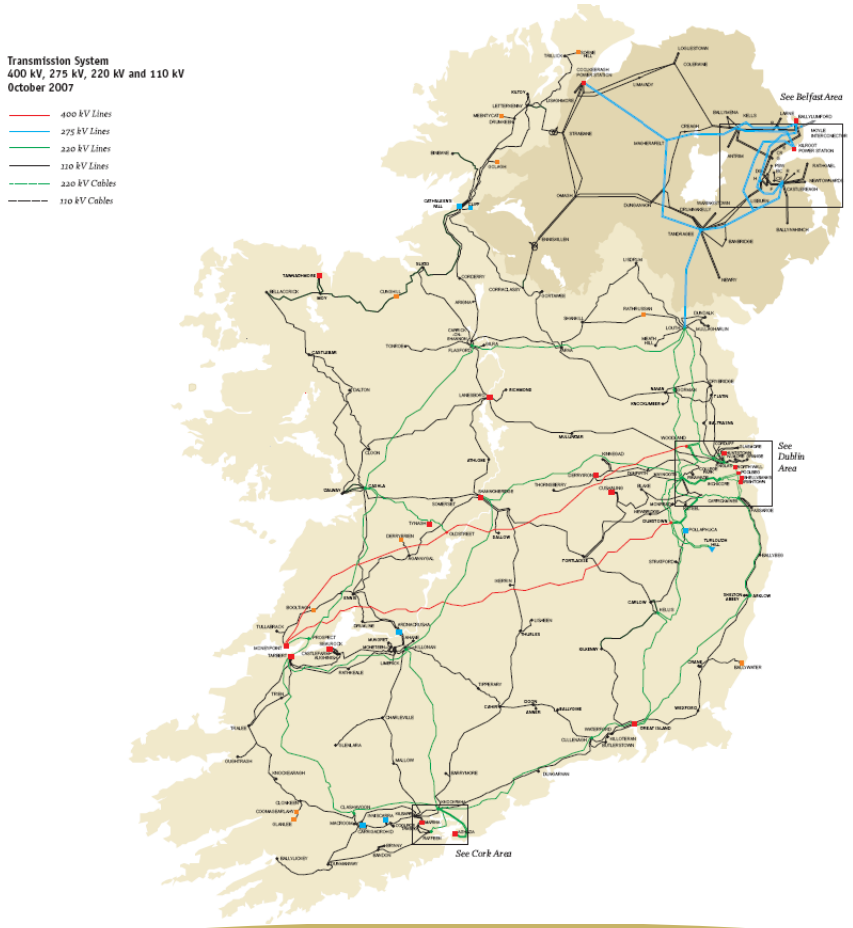
All Island Context



SONI

semo
Single Electricity Market Operator

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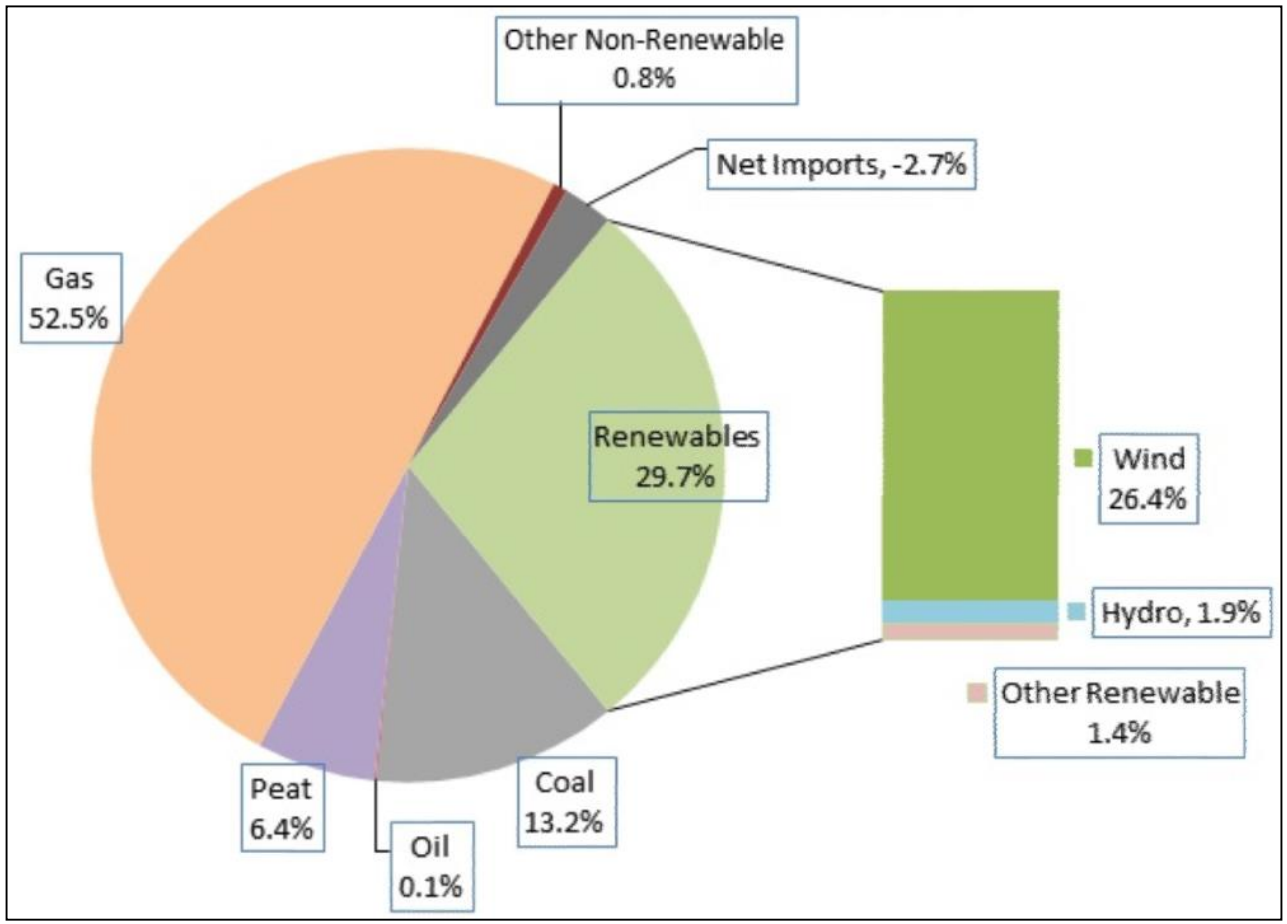
Fuel Mix



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So why are we relevant…?

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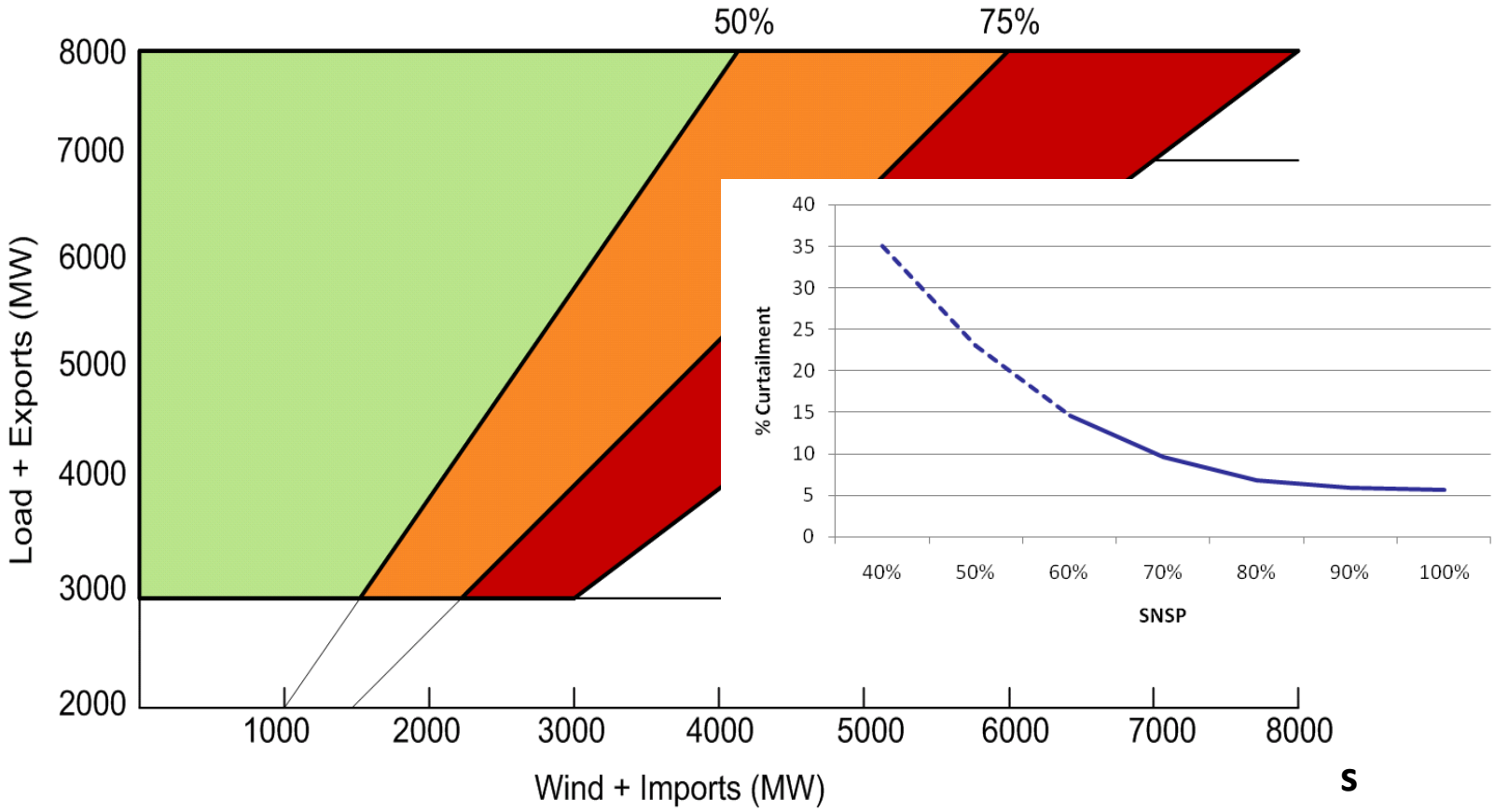
What's the problem...?



Maxim **s**

$$\text{SNSP} = \frac{\text{Wind + Imports}}{\text{Demand + Exports}}$$

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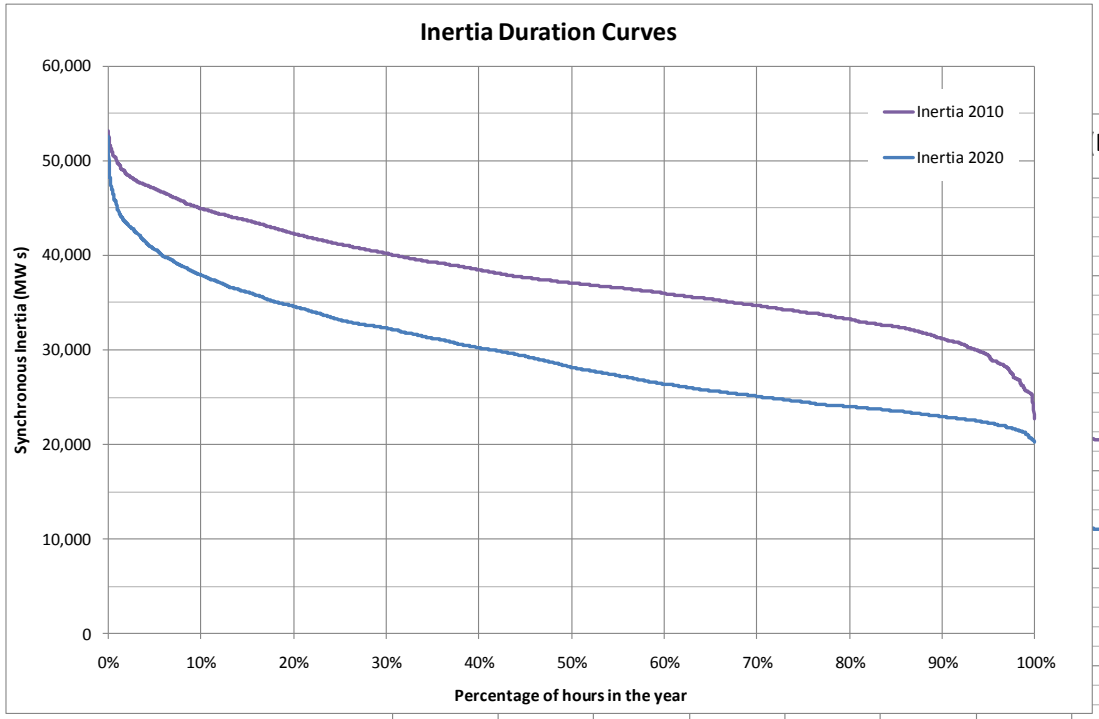
…as a result of new system scarcities



Today – Enabling 65% SNSP in Real-Time

1. Active and Reactive control of wind farms
   - Response in 10 seconds from control centre
2. Best in class wind forecasting
   - Contracted with best commercially available
3. On-line real-time dynamic assessment
   - WSAT determines transient and voltage stability and informs decision making
4. Enforcement of standards on all generators
   - Enhanced performance monitoring
   - Increased performance incentives
5. Accurate System Metrics
   - Updated SNSP calculations

$$\text{SNSP} = \frac{\text{Wind + Imports}}{\text{Demand + Exports}}$$

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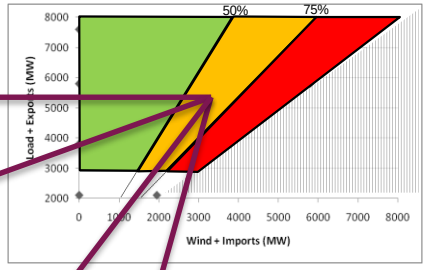
Tomorrow – Achieving 75% SNSP

1. RoCoF cascade failure
   - Loss of mains protection (G59)
   - Generator capability
2. Ramping
   - Increased variability and uncertainty over hours
3. System Voltage Control (Reactive)
   - 25% reduction in transmission online reactive power by 2020
   - 50% of new windfarms in distribution network
4. Maintaining System Transient Stability
   - Increased electrical distance between remaining generation
   - Require improved dynamic reactive response from wind farms



$$\text{SNSP} = \frac{\text{Wind + Imports}}{\text{Demand + Exports}}$$

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Changing Market Design for Investment

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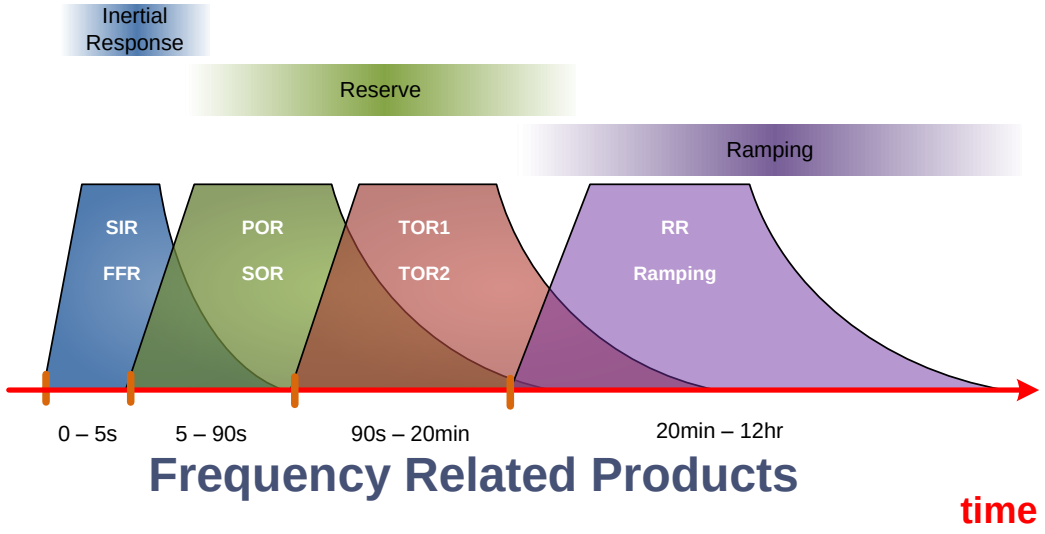
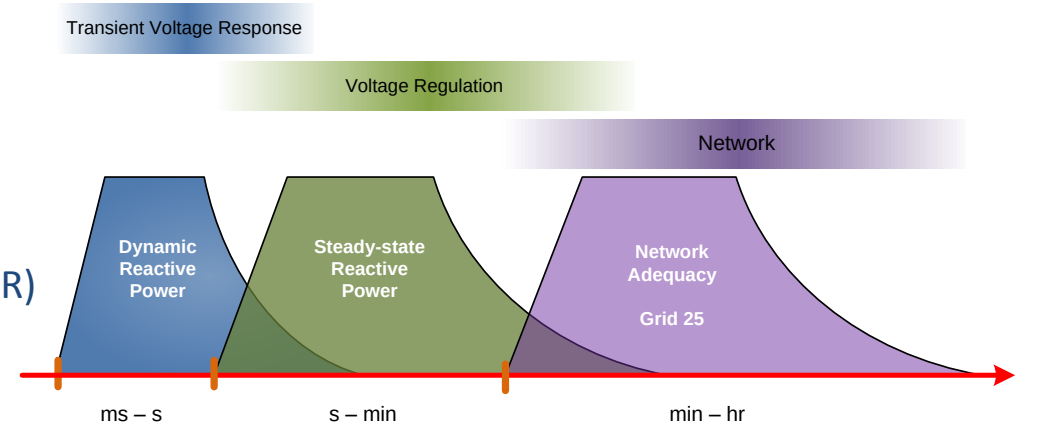
DS3 System Services Products

NEW
- Fast Frequency Response (FFR)
- Fast Post-Fault Active Power Recovery (FPFAPR)



Frequency Related Products

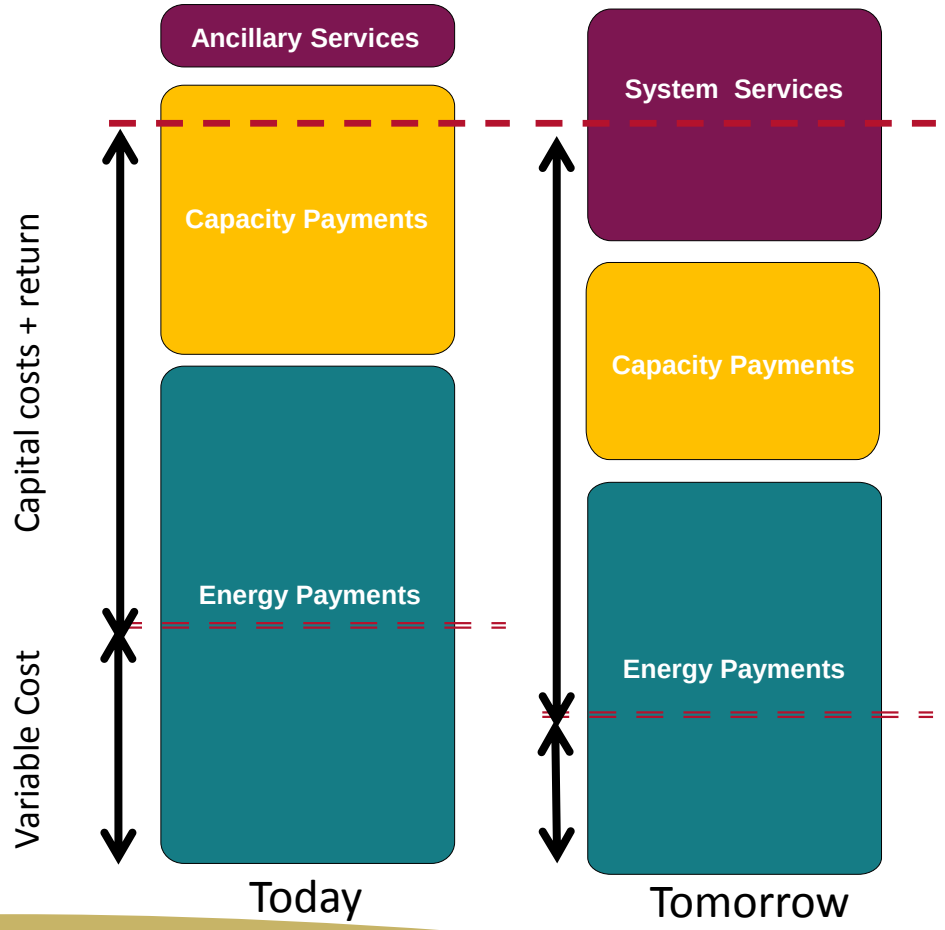
NEW
- Dynamic Reactive Response (DRR)



Voltage Related Products

Changing the Market Design for investment

- Financial Mix will move to higher capital lower variable cost technologies
- Incentivise performance to obtain the plant mix that matches the system requirements and achieves the policy objectives



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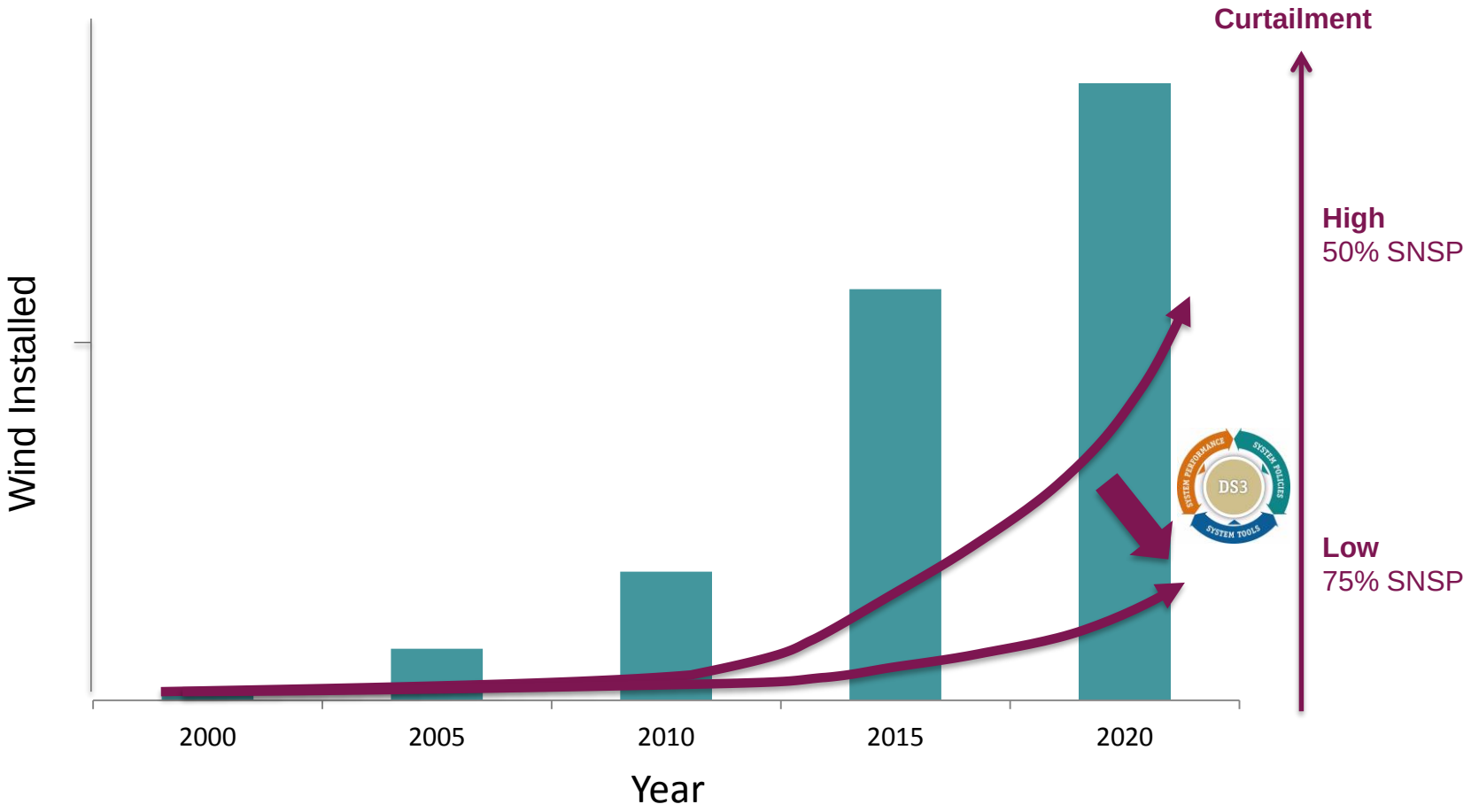
Effect of DS3 on Wind Curtailment



$$\text{SNSP} = \frac{\text{Wind + Imports}}{\text{Demand + Exports}}$$

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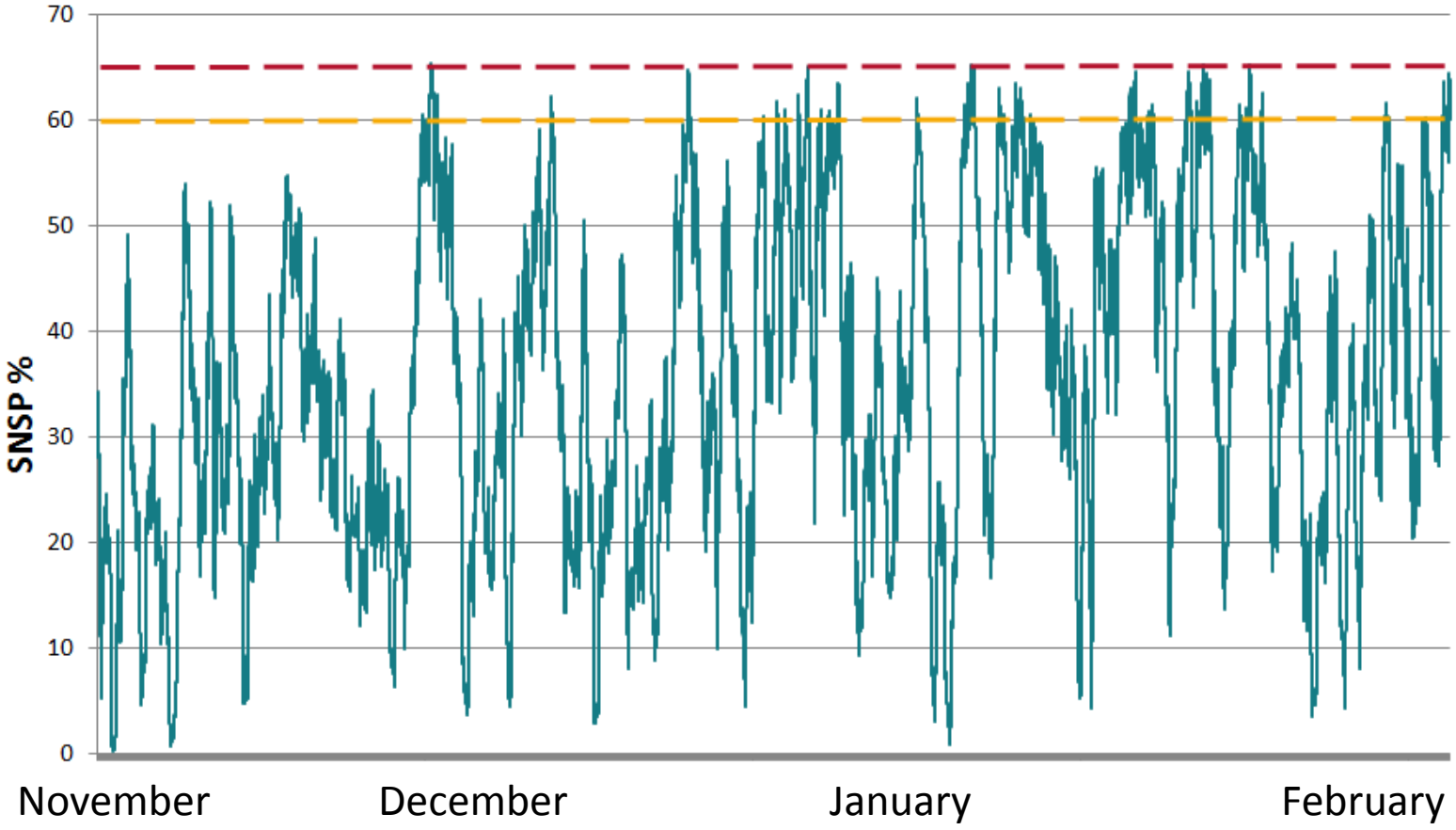
Operational Limit - 65% SNSP



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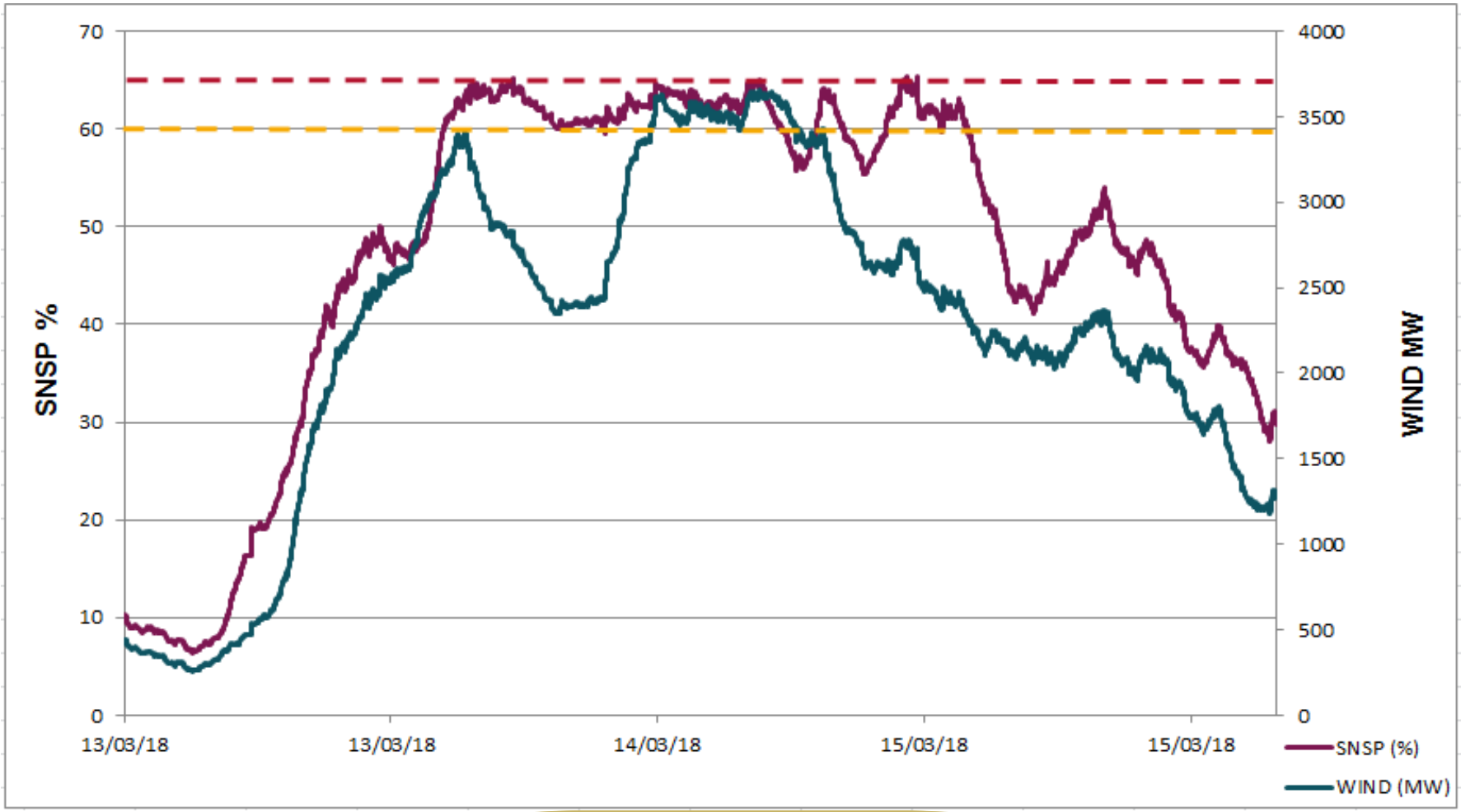
Which we are managing today….



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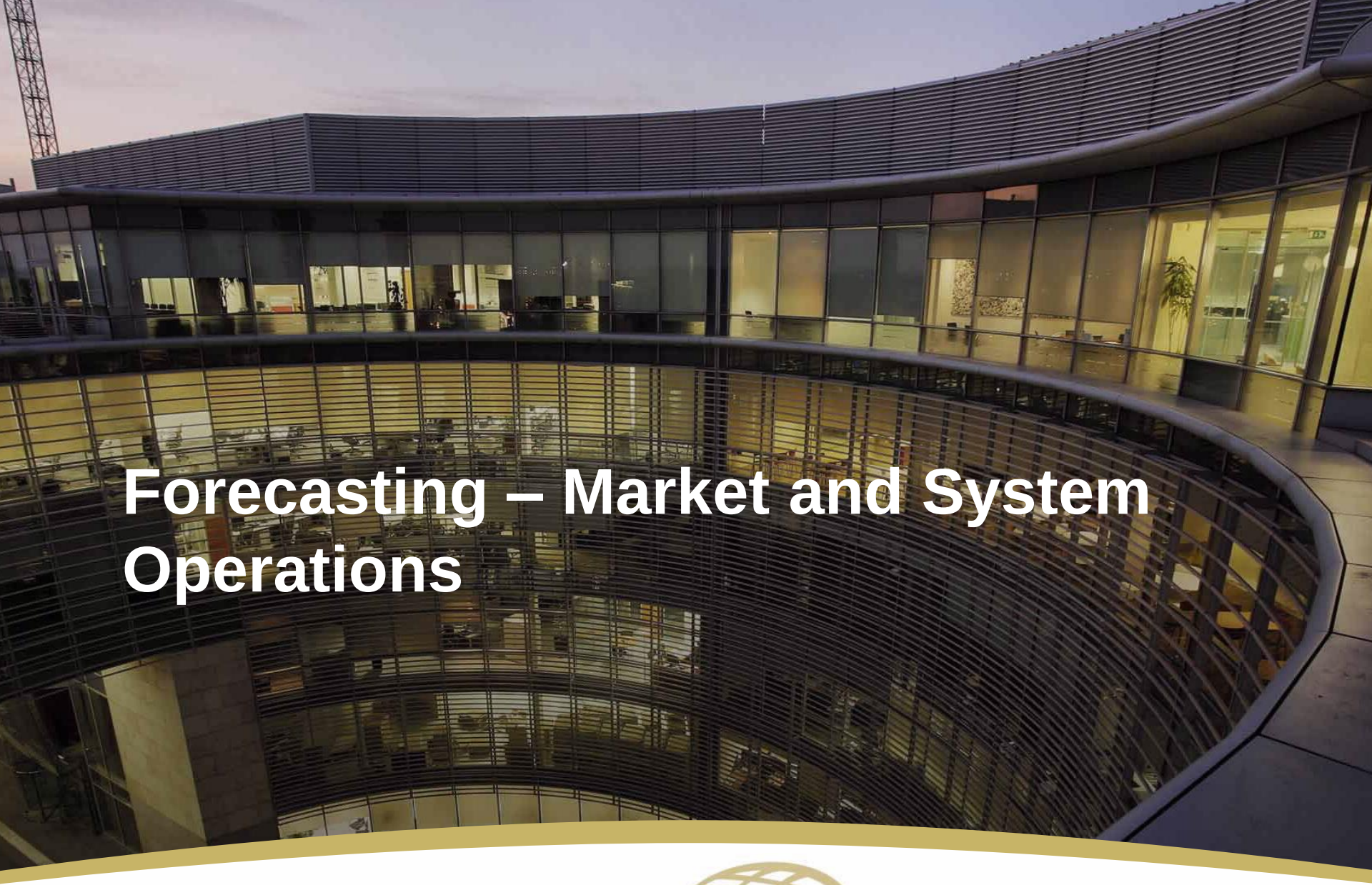

Forecasting – Market and System Operations

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Wind Forecasting

- Procure wind forecasts from 2 vendors
  - Uncertainty information
  - High wind speed shutdown warnings
- System Operations
  - Engineering judgement based merge of 2 forecasts
- Market Operations
  - Single forecast feeds MMS
  - No uncertainty information

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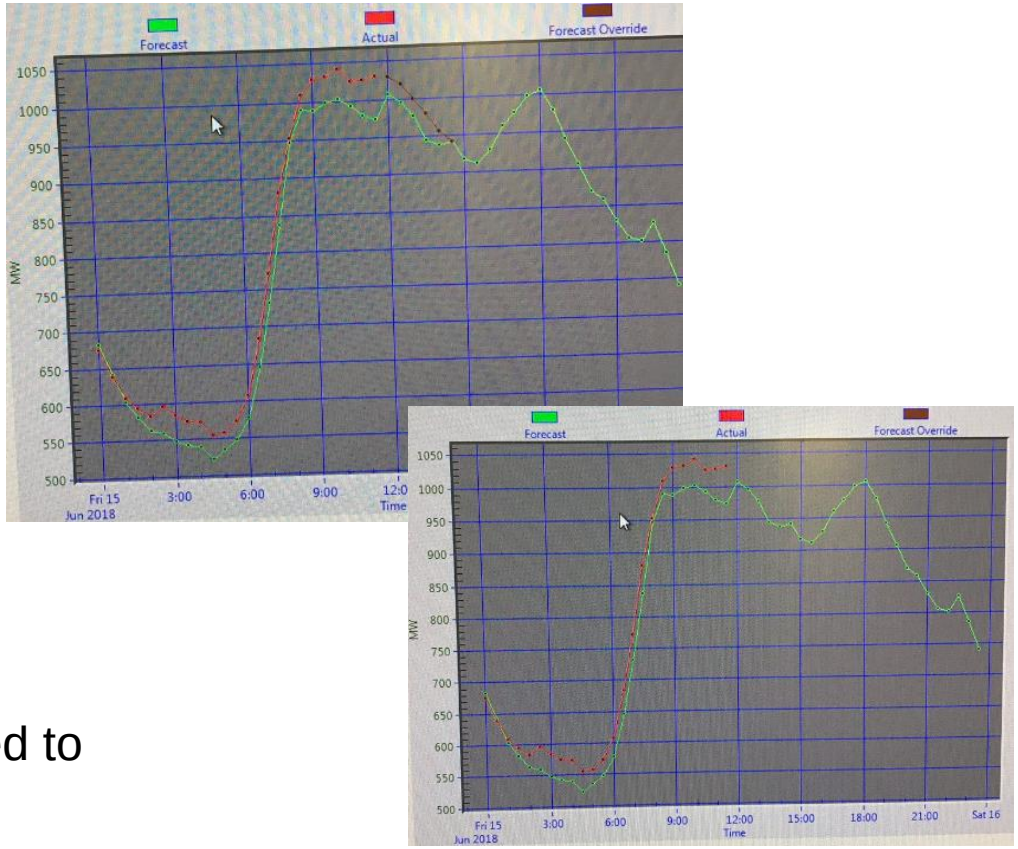
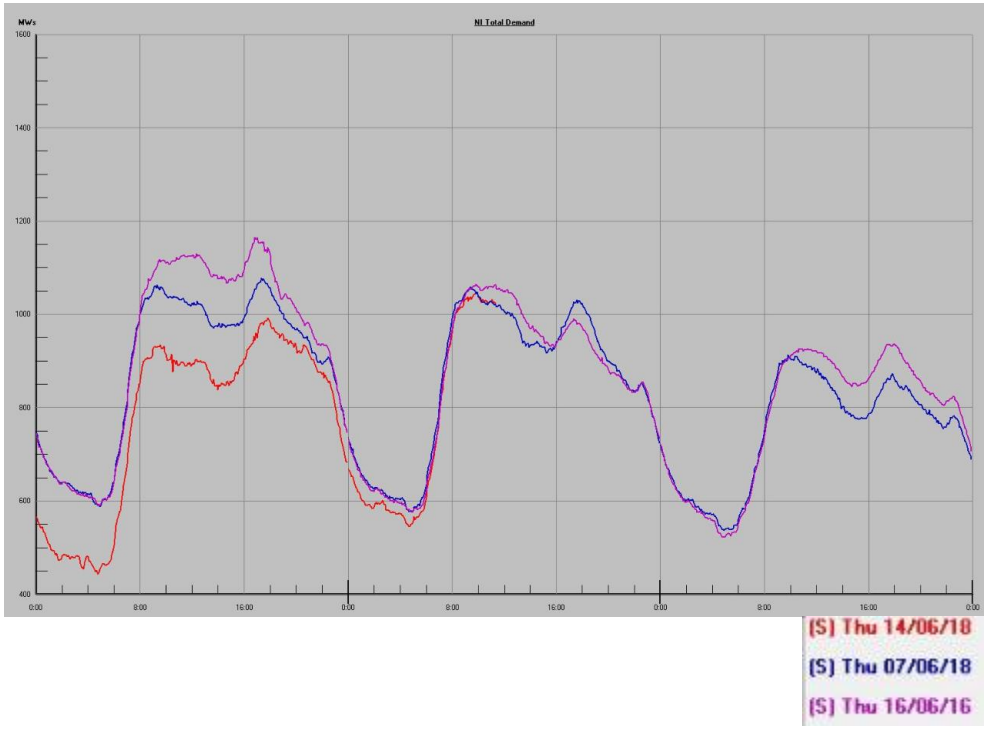
Demand Forecasting

- Demand forecast
  - Day of week
  - Weather
  - Special Days
  - 5 years of historical data
- System Operations
  - Forecast changed based on engineering judgement
- Market Operations
  - Unchanged forecast submitted to MMS



Forecasting Challenges - Load

- Historical data no longer representative of forecast demand levels
  - Embedded generation
  - Energy efficiencies
  - Prosumers



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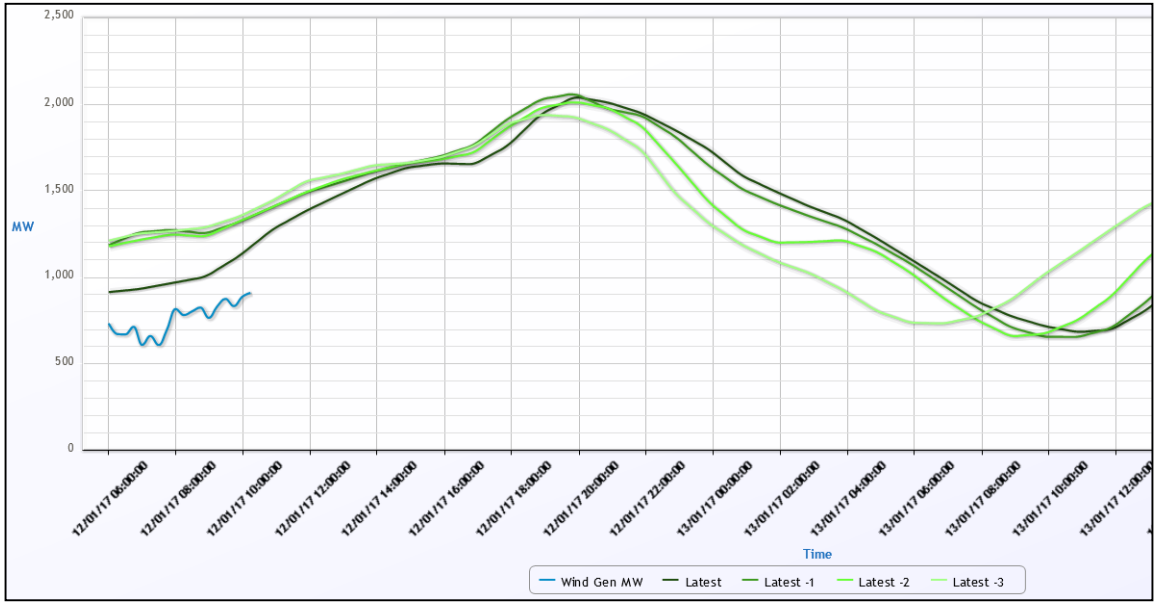
Forecasting Challenges – Generation



- Error at steepest part of wind curve – error of 1-2 m/s has significant impact on MW
- As installed capacity increases, these errors will increase proportionally

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System Operation Tools Using Forecasts

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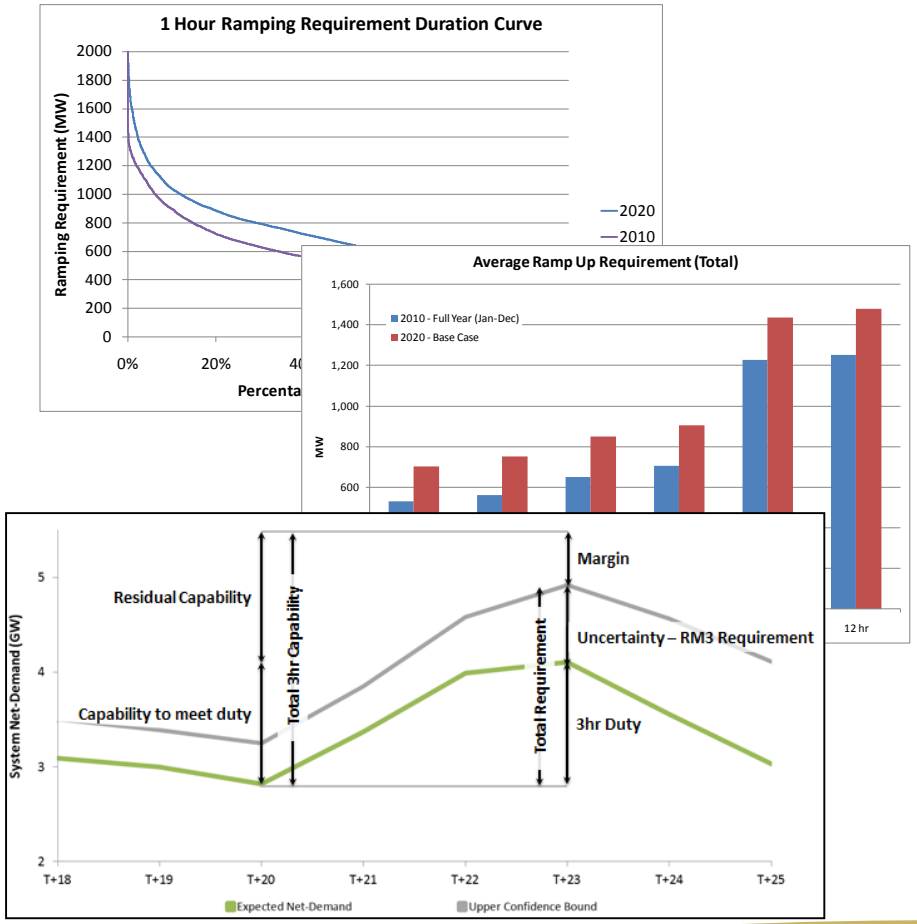
Ramping Tool



- Calculates ramping requirement across multiple time horizons
- Calculation based on:
  - Variability
  - Forecast error
- Requirement will be a constraint in the market scheduling process
- Closely linked to market systems

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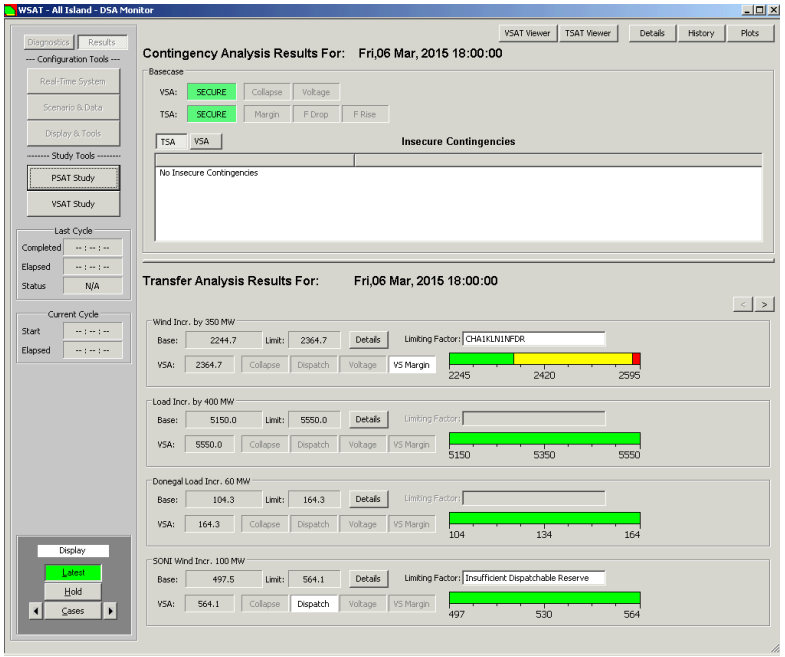
Look Ahead Wind Security Assessment Tool

- Decision support tool
- Assess system stability for key transfers
- Forward looking analysis based on forecasted system conditions
- Optimise operator actions across multiple time horizons
- Facilitates reduction of minimum sets rule



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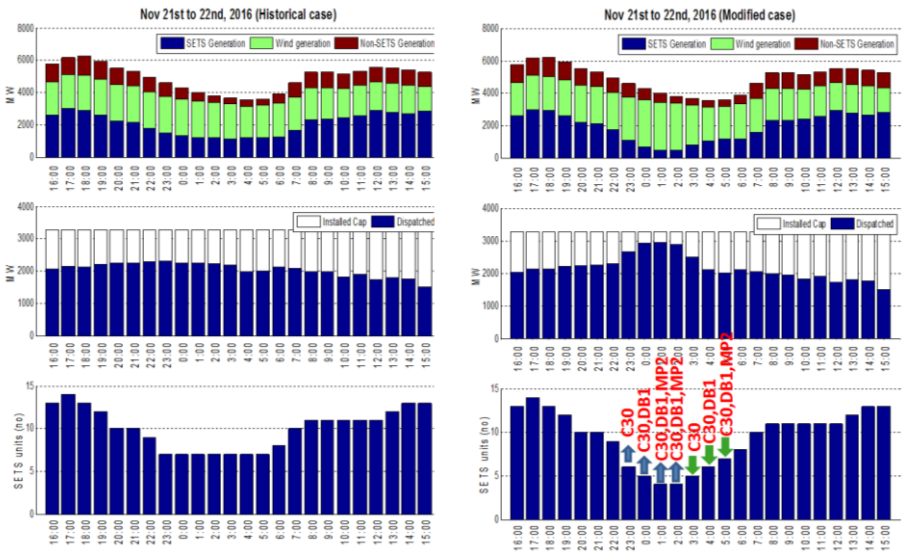
Voltage Trajectory Tool



- Efficient management of reactive power sources
- Produces reactive power dispatch schedule
- Optimised across multiple time horizons
- Considers key contingencies
- Realistic number of operator actions

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